UNIVERSITY OF JOHANNESBURG

# FACULTY OF SCIENCE

## DEPARTMENT OF APPLIED CHEMISTRY

BACHELOR OF HEALTH SCIENCE: EMERGENCY MEDICAL CARE
SHORT LEARNING PROGRAM: EMERGENCY MEDICAL CARE
NATIONAL DIPLOMA: PODIATRY

**MODULE** CHB1BB1, CHEM001, CET1BH1
BASIC SCIENCE: CHEMISTRY

**CAMPUS** **DFC**

## NOVEMBER EXAMINATION

**DATE:** **06/11/2015** **SESSION:** **08:30 – 10:30**

**ASSESSORS** **MS L E MACKECHNIE**
**DR A A ADELODUN**

**INTERNAL MODERATOR** **DR S P MALINGA**

**DURATION** **2 HOURS** **MARKS 90**

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**NUMBER OF PAGES: 5 PAGES AND 1 ANNEXURE**

**INSTRUCTIONS:** **CALCULATORS ARE PERMITTED (ONLY ONE PER STUDENT)**

**REQUIREMENTS:** **1 x UJ MULTIPLE-CHOICE ANSWER SHEET**
**1 x EXAMINATION BOOK**

**PHYSICAL CONSTANTS:**

| | |
|---|---|
| Avogadro's number: | $N_A$ = 6,022 x $10^{23}$ particles $mol^{-1}$ |
| Volume: | 1 litre, L = 1000 mL ≡ 1 $dm^3$ = 1000 $cm^3$ |
| Molarity: | 1 *M* ≡ 1 $mol.L^{-1}$ ≡ 1 $mol.dm^{-3}$ |
| pH : | pH = − log $[H_3O^+]$ |
| $K_W$ : | 1 x $10^{-14}$ = $[H_3O^+][OH^-]$ |

*A Periodic Table is attached to this question paper*.

***INSTRUCTIONS – SECTION 1***

1. *Write your name and fill out your student number on the multiple-choice answer sheet.*
2. *Do not fold or staple the multiple choice answer sheet.*
3. *Indicate each answer clearly by blocking out the chosen letter, preferably with a* ***soft pencil*** *although pen can be used.*
4. *Only* ***one*** *answer per question is correct. There will be no negative marking to penalise incorrect answers, but if you enter more than one choice per question you will receive zero for that question.*
5. *Use pencils only for SECTION 1. Mistakes can be corrected by using an eraser or typex. Once erased, your new choice must be indicated as described on the multiple-choice answer sheet.*

**SECTION 1 – MULTIPLE CHOICE**

1. Which of the following element pairs has similar chemical properties?

A P and As
B Sn and Sb
C B and N
D Si and Cl

2. What is the identity of $^{59}_{25}X$?

A Cobalt, Co
B Manganese, Mn
C Praseodymium, Pr
D Polonium, Po

3. Which quantity represents 39 grams of LiF?

A 1.0 mol
B 2.0 mol
C 0.5 mol
D 1.5 mol

4. If you have a sample of $C_3H_8O_2$ that has 2.00 g of hydrogen, what mass of $C_3H_8O_2$ do you have?

A 76.0 g
B 19.0 g
C 152 g
D 38.0 g

5. Which of the following radiations is generally harmless?

A. Ultra-violet radiation
B. X-rays
C. Radio waves
D. Gamma radiations

6. When the equation below is balanced, the stoichiometric coefficient of $O_2$ would be

___ $C_5H_{10}O$ + ___ $O_2$ → ___ $CO_2$ + ___ $H_2O$

A 7
B 8
C 13
D 15

7. How many moles of $C_4H_{10}$ would react with 4,50 moles of $O_2$ according to the following balanced equation?

$2C_4H_{10} + 13O_2 \rightarrow 8CO_2 + 10H_2O$

A 0.690 mol
B 3.26 mol
C 29.3 mol
D 34.7 mol

8. Equal volumes of ammonia and nitrogen gases at the same temperature and pressure would have the same

A masses
B number of atoms
C number of molecules
D percent nitrogen

9. What product forms when $^{232}Th$ undergoes alpha decay?

A $^{236}U$
B $^{228}Th$
C $^{232}Pa$
D $^{228}Ra$

10. What mass of 32 g sample of $^{60}Co$ will remain unchanged after 21.2 years? (Half-life = 5.3 years)

A 1,0 g
B 2,0 g
C 8,0 g
D 4,0 g

11. What is the molarity of a solution containing 45.0 g of $Na_2CO_3$ (105.99 $g.mol^{-1}$) dissolved in 225 mL of water?

A 0,0961 M
B 0,122 M
C 1,89 M
D 2,41 M

12. Bases that only dissociate partially in water are referred to as

A Strong bases
B Weak bases
C Arrhenius bases
D Bronsted-Lowry bases

13. The molarity of a KOH solution that has a pH of 8,25 is:

A $5.623 \times 10^{-9}$ M
B $1.778 \times 10^{8}$ M
C $1.778 \times 10^{-6}$ M
D $5.623 \times 10^{5}$ M

14. What is the general formula for an alcohol?

A R–O–H
B R–CO–R
C R–CO–O–R
D R–CO–H

15. Which of the following organic substances has/have "–OH" in its/their formula?

(i) ester (ii) carboxylic acid (ii) alcohol

A (i) only
B (iii) only
C (i) and (ii)
D (ii) and (iii)

**[15 x 2 = 30]**

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## SECTION 2

## QUESTION 1

1.1.1 Draw a Bohr model for chlorine gas and identify the core electrons and valence electrons. (4)

1.1.2 What type of bonding occurs in a chlorine molecule? (1)

1.1.3 Draw the Lewis dot structure of the ion formed when a chlorine atom reacts and give the name of this ion. (2)

1.1.4 What is the name of the group in the periodic table that chlorine belongs to? (1)

1.2 Coca-cola™ gets its name from the coca leaves that were originally used to make the product in the 1880s. These leaves contain traces of cocaine and for this reason the addition of coca extract to Coca-cola was stopped in 1929. Cocaine has the formula: $C_{17}H_{21}NO_4$.

1.2.1 Calculate the molar mass of cocaine. (2)

1.2.2 State the total number of atoms in one molecule of cocaine. (1)

1.2.3 Calculate the mass percentage hydrogen in cocaine. (2)

1.2.4 Calculate the mass in grams of 1.65 moles of cocaine. (2)

1.2.5 If you have 75.85 g of cocaine, how many moles of cocaine do you have? (2)

**[17]**

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## QUESTION 2

2.1 Phosphorus is converted to phosphoric acid according to the following unbalanced equation.

$P_4 + O_2 + H_2O \rightarrow H_3PO_4$

2.1.1 Balance the equation. (3)

2.1.2 Calculate the mass of phosphorus required to produce 125 g of phosphoric acid. (3)

2.1.3 Phosphoric acid is a *weak, polyprotic* acid. Explain fully what the terms "weak" and "polyprotic" mean. (4)

2.1.4 List four properties of acids. (2)

2.2.1 Give 4 properties of gamma rays. (4)

2.2.2 Give two uses for X-rays. (2)

2.2.3 State how you would protect yourself against X-rays. (1)

2.3 Explain in 5 major steps why deep sea divers use a helium-oxygen gas mixture instead of a nitrogen-oxygen gas mixture for breathing. (5)

2.4 Give a reason why rain water is slightly acidic (pH = 5.6)?. (2)

**[26]**

## QUESTION 3

3.1 Write brief notes on water. Your answer should include information about the physical and chemical properties of water, the bonding in the water as well as an explanation of autoionisation and how this gives water a pH of 7 at 25°C. Use appropriate diagrams to illustrate your answer. (8)

3.2 Cooking oils derived from plants such as sunflowers are described as *polyunsaturated*. Explain what "polyunsaturated" means and use an appropriate diagram to illustrate your answer. (3)

3.3.1 Give the general formula for an amino acid. (2)

3.3.2 Use an equation to describe how two amino acids react together. (2)

3.3.3 Name three carbon compounds that are not organic? (1)

3.4 Give the formulas for the products formed from the following organic reactions.

3.4.1 $CH_3–CH_2–CH=CH–CH_3 + Cl_2 \rightarrow ?$ (1)

3.4.2 $CH_3–CH_2–CH_2OH + CH_3CH_2COOH \rightarrow ? + ?$ (2)

3.4.3 For Question 3.4.1 and 3.4.2 state what types of reactions are occurring. (2)

**[21]**